Pacific Gas and Electric Company®

Diablo Canyon Power Plant
P. O. Box 56
Avila Beach, CA 93424

December 22, 2008

PG&E Letter DCL-08-109

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, DC 20555-0001

Docket No. 50-323, OL-DPR-82
Diablo Canyon Unit 2
Licensee Event Report 2-2008-002-00
Manual Reactor Trip Due to Pacific Ocean Circulating Water System Debris

Dear Commissioners and Staff:

In accordance with 10 CFR 50.73(a)(2)(i)(B) and 10 CFR 50.73(a)(2)(iv)(A), Pacific Gas and Electric Company is submitting the enclosed licensee event report regarding a manual reactor trip due to the sudden increase in debris loading of the Pacific Ocean circulating water system traveling screens.

There are no new or revised regulatory commitments in this report.

This event did not adversely affect the health and safety of the public.

Sincerely,

James R. Becker
Site Vice President

ddm/2246/50081669
Enclosure
cc/enc: Elmo E. Collins, NRC Region IV
Michael S. Peck, NRC Senior Resident Inspector
Alan B. Wang, NRR Project Manager
INPO
Diablo Distribution

IE22
NRR

NRC FORM 366 (6-2004) U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB: NO. 3150-0104 EXPIRES: 06/30/2007

Estimated burden per response to comply with this mandatory collection request: 50 hours. Reported lessons learned are incorporated into the licensing process and fed back to industry. Send comments regarding burden estimate to the Records and FOIA/Privacy Service Branch (T-5 F52), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by internet e-mail to infocollects@nrc.gov, and to the Desk Officer, Office of Information and Regulatory Affairs, NEOB-10202, (3150-0104), Office of Management and Budget, Washington, DC 20503. If a means used to impose an information collection does not display a currently valid OMB control number, the NRC may not conduct or sponsor, and a person is not required to respond to, the information collection.

LICENSEE EVENT REPORT (LER)

(See reverse for required number of digits/characters for each block)

1. FACILITY NAME	2. DOCKET NUMBER	3. PAGE
Diablo Canyon Unit 2	05000323	1 OF 7

4. TITLE

Manual Reactor Trip Due to Pacific Ocean Circulating Water System Debris

5. EVENT DATE			6. LER NUMBER			7. REPORT DATE			8. OTHER FACILITIES INVOLVED	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REV NO.	MONTH	DAY	YEAR	FACILITY NAME	DOCKET NUMBER
10	21	2008	2008	- 002 -	00	12	19	2008	FACILITY NAME	DOCKET NUMBER

9. OPERATING MODE

1

10. POWER LEVEL

100

11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR§: *(Check all that apply)*

- ☐ 20.2201(b)
- ☐ 20.2201(d)
- ☐ 20.2203(a)(1)
- ☐ 20.2203(a)(2)(i)
- ☐ 20.2203(a)(2)(ii)
- ☐ 20.2203(a)(2)(iii)
- ☐ 20.2203(a)(2)(iv)
- ☐ 20.2203(a)(2)(v)
- ☐ 20.2203(a)(2)(vi)
- ☐ 20.2203(a)(3)(i)
- ☐ 20.2203(a)(3)(ii)
- ☐ 20.2203(a)(4)
- ☐ 50.36(c)(1)(i)(A)
- ☐ 50.36(c)(1)(ii)(A)
- ☐ 50.36(c)(2)
- ☐ 50.46(a)(3)(ii)
- ☐ 50.73(a)(2)(i)(A)
- ☒ 50.73(a)(2)(i)(B)
- ☐ 50.73(a)(2)(i)(C)
- ☐ 50.73(a)(2)(ii)(A)
- ☐ 50.73(a)(2)(ii)(B)
- ☐ 50.73(a)(2)(iii)
- ☒ 50.73(a)(2)(iv)(A)
- ☐ 50.73(a)(2)(v)(A)
- ☐ 50.73(a)(2)(v)(B)
- ☐ 50.73(a)(2)(v)(C)
- ☐ 50.73(a)(2)(v)(D)
- ☐ 50.73(a)(2)(vii)
- ☐ 50.73(a)(2)(viii)(A)
- ☐ 50.73(a)(2)(viii)(B)
- ☐ 50.73(a)(2)(ix)(A)
- ☐ 50.73(a)(2)(x)
- ☐ 73.71(a)(4)
- ☐ 73.71(a)(5)
- ☐ OTHER

Specify in Abstract below or in NRC Form 366A

12. LICENSEE CONTACT FOR THIS LER

FACILITY NAME	TELEPHONE NUMBER (Include Area Code)
Steven W. Hamilton – Senior Regulatory Services Engineer	(805) 545-3449

13. COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT

CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX	CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX
				No					

14. SUPPLEMENTAL REPORT EXPECTED

☐ YES *(If yes, complete 15. EXPECTED SUBMISSION DATE)* ☒ NO

15. EXPECTED SUBMISSION DATE

MONTH	DAY	YEAR

ABSTRACT *(Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines)*

On October 21, 2008, at 20:49 PDT, with Unit 2 in Mode 1 (Power Operation) at approximately 55 percent power, a manual Reactor Trip was initiated due to the failure of the Pacific Ocean Circulating Water System (CWS) debris removal system to maintain adequate flow for power operation. Plant operators stabilized Unit 2 in Mode 3 (Hot Standby) and made an emergency event notification (EN#44588) in accordance with 10 CFR 50.72(a)(1)(i) at 22:44 PDT.

This event was due to a sudden large influx of Moon Jellyfish in the Pacific Ocean CWS that exceeded the ability of the debris removal system to effectively remove. PG&E has developed extensive models to help predict the impact of Pacific Ocean storms associated with CWS debris removal, and to give adequate time to prepare for such events. PG&E could not have anticipated this event and the potential adverse affects from the sudden large influx of jellyfish.

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I. Plant Conditions

Unit 2 was in Mode 1 (power operation) at approximately 100 percent power prior to the event.

II. Description of Problem

A. Background

Due to the location of the Diablo Canyon Power Plants (DCPP), Units 1 and 2, on the open, rocky coastline of California the intake is "protected" by two breakwaters. The east and west breakwaters and the existing shoreline form an intake cove that is roughly rectangular in shape and about 1,000 feet by 450 feet in size. The intake structure itself measures about 250 feet across and is located directly across from the opening between the east and west breakwaters. Water depth is about 30 feet at the intake structure and about 100 feet just outside the entrance to the intake cove. The bottom quickly drops away as you move offshore and exceeds 600 feet within five miles of shore.

The circulating water system (CWS)[KE] provides a continuous saltwater supply to the main condenser [COND], condensate cooler [CLR], service water cooling system [KG], and intake cooling system [KE]. The Pacific Ocean saltwater enters the cooling water intake structure by passing through bar racks and then through traveling screen assemblies. Each unit has two single-stage circulating water pumps (CWP) and each CWP has three traveling screens. The bar racks and traveling screens prevent debris and sea life from entering the CWS and restricting flow through the main condenser. The traveling screens for the CWPs are operated either in manual or automatic. When in manual, the screens are controlled by the operator and can be operated in slow or high speed.

Due to the location of the intake structure within the intake cove, flow tends to be toward the Unit 2 side of the structure when all four CWPs are in service. This leads to more debris captured by the Unit 2 bar racks and screens. With the Unit 2 pumps off, flow then tends toward the Unit 1 side. If all four CWPs are in service and Unit 2 pumps are removed from service, any debris on the Unit 2 screens will be backwashed off the screens and be pulled toward Unit 1.

Current from the intake of water via the CWPs drew the jellyfish to the bar racks and onto the traveling screens in greater numbers than the screen system is designed to handle. In addition to entering the intake cove in

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large numbers, the jellyfish were large, approximately 16 inches in diameter and 30 pounds in weight. Jellyfish fully loaded the screens with an estimated 100 to 200 pounds extra weight that each screen mesh basket carried when the screens were out of the water. Since eleven screen baskets are out of the water for washing, the system had to raise 1100 to 2200 pounds of extra weight in addition to the increased friction force of screens being pressed against the support structure by differential pressure (dP) across the jellyfish-blocked mesh baskets. The screen drives overloaded and stopped. Shear pins failed due to the overload so screens could not be restarted. Screen dPs rose rapidly, necessitating operator action to secure CWPs per OP AP A-7, "Degraded Condenser," to prevent equipment damage.

PG&E routinely sends commercial divers into the area in front of the bar racks to check for accumulation of debris and assist in its removal. Prior to this event no jellyfish or significant debris accumulation was identified.

B. Event Description

On October 21, 2008, at approximately 20:37 PDT Unit 2 plant operators received an automatic start on high dP alarm for the Pacific Ocean CWS debris removal screens.

On October 21, 2008, at approximately 20:38 PDT Unit 2 plant operators received a traveling "screen dP high / screen not in motion" alarm.

On October 21, 2008, at approximately 20:39 PDT Unit 1 plant operators received a "screen differential high autostart" alarm in the control room.

On October 21, 2008, at approximately 20:40 PDT Unit 1 plant operators received a "screen differential high / screen not in motion" alarm.

On October 21, 2008, at approximately 20:42 PDT Unit 2 plant operators initiated a main main generator ramp to 550 MW at 50 MW per minute, and increased the ramp rate to 100 MW per minute. Utility licensed plant operators identified that the screen dP had increased to over 70 inches.

On October 21, 2008, at approximately 20:43 PDT Unit 2 CWP 2-2 dP increased rapidly similar to that seen on CWP 2-1.

On October 21, 2008, at approximately 20:45 PDT the Unit 2 CWP screens were manually selected to high speed debris removal mode.

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On October 21, 2008, at approximately 20:46 PDT Unit 2 CWP 2-1 is manually tripped at an indicated dP of 80 inches in accordance with Operating Procedure OP AP-7, Section C, that dictates a reduced load shutdown if the screen dP is 70 inches or more.

On October 21, 2008, at approximately 20:49 PDT Unit 2 plant operators initiated a manual reactor trip and shut down CWP 2-2 in accordance with OP AP-7.

On October 21, 2008, at approximately 20:50 PDT the Unit 2 auxiliary saltwater (ASW) pump 2-1 autostarted on transfer of electrical power from the auxiliary transformer to the 230kV startup transformer (SUT).

On October 21, 2008, at approximately 20:52 PDT Unit 1 CWP 1-2 dP rapidly increases to approximately 55 inches.

On October 21, 2008, at approximately 21:01 PDT Unit 1 plant operators initiated a main generator ramp to 50 percent power.

On October 21, 2008, at approximately 21:10 PDT Unit 1 plant operators stabilize Unit 1 at approximately 50 percent power.

On October 21, 2008, at approximately 22:44 PDT plant operators made a nonemergency event notification (EN#44588) in accordance with 10 CFR 50.72(b)(2)(iv)(B) and 50.72(b)(3)(iv)(A).

C. Status of Inoperable Structures, Systems, or Components that Contributed to the Event

None.

D. Other Systems or Secondary Functions Affected

No additional Unit 2 safety systems were adversely affected by this event.

Unit 1 was affected and reduced load to approximately 50 percent power.

E. Method of Discovery

The event was self-revealing to licensed control room operators by annunciators and alarms in the control room.

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F. Operator Actions

Utility licensed plant operators stabilized Unit 2 in Mode 3 at normal operating temperature and pressure.

Plant operators made a nonemergency phone notification (EN#44588) in accordance with 10 CFR 50.72(b)(3)(iv)(A) and 10 CFR 50.72(b)(3)(iv)(B).

G. Safety System Responses

All systems responded as designed. All control rods fully inserted as designed. The auxiliary feedwater system actuated as designed. The vital electrical power loads were transferred to the 230kV startup power as designed. Diesel generators (DGs) 2-2 and 2-3 were operable in standby. DG 2-1 was inoperable due to scheduled maintenance. The traveling screens for the safety-related ASW system were not degraded and managed the influx of jellyfish with no significantly elevated dP observed.

III. Cause of the Problem

A. Immediate Cause

A mass influx of Moon Jellyfish overloaded the debris removal system of the Pacific Ocean main condenser cooling water supply.

B. Root Cause (RC)

RC1 DCPP's predictive capability for intake screen blocking events is limited to storm events, principally to events related to high swells with large kelp loads.

RC2 Intake traveling screen debris removal capabilities are insufficient to manage ocean debris material loads beyond those experienced in storm events.

IV. Assessment of Safety Consequences

There were no safety consequences as a result of this event.

The 4kV vital electrical loads transferred from the main generator output (25kV) via the auxiliary transformer to the startup transformer (230kV offsite power) as designed. The Reactor Protection System reactor trip signal allowed the reactor control rods to drop into the core shutting down the reactor as designed. Two

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motor-driven auxiliary feedwater pumps started and provided cooling water to the four steam generators cooling the reactor coolant system as designed. The loss of main generator electrical output is a previously analyzed Condition II event as described in the Final Safety Analysis Report Update (FSARU), Chapter 15.2, "Condition II – Faults of Moderate Frequency."

Unit 1 reactor power was reduced to approximately 50 percent with vital buses powered from its auxiliary transformer.

Therefore, the event is not considered risk significant and it did not adversely affect the health and safety of the public.

V. Corrective Actions

A. Immediate Corrective Actions

Plant operators manually tripped Unit 2 and reduced Unit 1 reactor power in accordance with established plant procedures.

B. Corrective Actions to Prevent Recurrence (CAPR)

CAPR1 Develop and implement predictive methodology to support plant operations:

1. Install surveillance device (multiple underwater cameras) at intake structure to facilitate real-time assessment of conditions at bar racks / screens.
2. Install detection device at entrance to intake cove.
3. Incorporate image recognition software into detection device output to assess influx parameters.
4. Operations and Chemistry and Environmental Operations develop plant operating strategies based on data obtained.

CAPR2 Improve equipment performance to better manage ocean debris material loads:

1. Set screen maximum speed to highest speed available.
2. Change switch configuration for screen drives so that screens do not stop between auto and Hi speed (to eliminate high starting torque on system in service).
3. Re-evaluate and reset torque limits on screen drives to reduce shear pin breakage.
4. Upgrade screen wash maximum flow capability.

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VI. Additional Information

A. Failed Components

None.

B. Previous Similar Events

LER 1-2006-001, "Excessive Dead Birds Found at the Pacific Ocean Cooling Water Intake," submitted via DCL-06-108, dated September 14, 2006, reported an unusually large number of dead birds on the bar racks. This event was due to natural causes of mortality of the Cormorants that often feed in the DCPP intake cove. No corrective actions for this event were identified since the deaths were not related to DCPP operation and did not have a significant adverse impact on the operation of the plant.